CLAIMS

Having described the preferred embodiments, the invention is now claimed to be:

- 1. A magnetic resonance imaging scanner comprising:
- a magnet (20) generating a temporally constant magnetic field;
- one or more magnetic field gradient-generating structures (30) superimposing selected magnetic field gradients on the temporally constant magnetic field;
 - a radio frequency shield (64);
- a radio frequency coil (32) disposed inside of the radio frequency shield (64) and selectively producing a radio frequency field; and
- a magnetic field-modifying structure (60) designed to enhance the temporally constant magnetic field, the magnetic field-modifying structure being disposed inside of the radio frequency shield (64) and including particles of magnetic material (70₁, 70₂, 70₃, 70₄) generally smaller in at least one dimension than a skin depth of the radio frequency field in the magnetic material dispersed in an insulating binder (72).
- 2. The magnetic resonance imaging scanner as set forth in claim 1, wherein the particles of magnetic material $(70_1, 70_2, 70_3, 70_4)$ dispersed in the binder (72) have a fill factor of at least about 50% by volume.
- 3. The magnetic resonance imaging scanner as set forth in claim 1, wherein the particles of magnetic material $(70_1, 70_2, 70_3, 70_4)$ are generally smaller in at least one dimension than about one-tenth of the skin depth of the radio frequency field in the magnetic material.
- 4. The magnetic resonance imaging scanner as set forth in claim 1, wherein the particles of magnetic material $(70_1, 70_2, 70_3, 70_4)$ are generally smaller than about 10 microns in at least one dimension.
- 5. The magnetic resonance imaging scanner as set forth in claim 1, wherein the particles of magnetic material $(70_1, 70_2, 70_3, 70_4)$ are generally smaller than about 4 microns in at least one dimension.

6. The magnetic resonance imaging scanner as set forth in claim 1, wherein the particles of magnetic material $(70_1, 70_4)$ generally do not have a direction of elongation.

- 7. The magnetic resonance imaging scanner as set forth in claim 1, wherein the particles of magnetic material (70₂) are generally wire-shaped.
- 8. The magnetic resonance imaging scanner as set forth in claim 7, wherein the generally wire-shaped particles (70_2) are oriented with long directions generally transverse to the temporally constant magnetic field and generally parallel to a tangential direction.
- 9. The magnetic resonance imaging scanner as set forth in claim 1, wherein the particles of magnetic material (70₃) are generally planar.
- 10. The magnetic resonance imaging scanner as set forth in claim 9, wherein the generally planar particles (70₃) are oriented with plane normals generally parallel to the temporally constant magnetic field.
- 11. The magnetic resonance imaging scanner as set forth in claim 1, wherein the radio frequency coil (32) includes a plurality of parallel rungs, and the particles of magnetic material $(70_1, 70_2, 70_3, 70_4)$ are disposed at least partially between the rungs.
- 12. The magnetic resonance imaging scanner as set forth in claim 1, wherein the magnetic field-modifying structure (60) includes:
- a plurality of generally annular structures (62) containing particles of magnetic material $(70_1, 70_2, 70_3, 70_4)$, the generally annular structures (62) being oriented generally transverse to the temporally constant magnetic field, the annular structures (62) having annular cross-sections elongated transverse to the temporally constant magnetic field.
- 13. The magnetic resonance imaging scanner as set forth in claim 1, wherein the magnetic field-modifying structure (60) includes:
- a plurality of magnetic generally annular structures (62) containing the particles of magnetic material (70₁, 70₂, 70₃, 70₄) in the insulating binder (72), the magnetic generally annular structures (62) being oriented generally transverse to the temporally constant

magnetic field, the magnetic annular structures (62) having a longitudinal demagnetization factor (N_z) parallel to the temporally constant magnetic field and a tangential demagnetization factor (N_T) in a tangential direction transverse to the temporally constant magnetic field, the longitudinal demagnetization factor being larger than the tangential demagnetization factor to produce tangential flux guiding.

- 14. The magnetic resonance imaging scanner as set forth in claim 1, wherein the magnetic field-modifying structure (60) has a longitudinal demagnetization factor (N_z) parallel to the temporally constant magnetic field and a tangential demagnetization factor (N_T) in a tangential direction transverse to the temporally constant magnetic field, the longitudinal demagnetization factor being larger than the tangential demagnetization factor to produce tangential flux guiding.
 - 15. A magnetic resonance imaging scanner comprising:
 - a magnet (20) generating a temporally constant magnetic field;
- one or more magnetic field gradient-generating structures (30) superimposing selected magnetic field gradients on the temporally constant magnetic field;
 - a radio frequency coil (32) selectively producing a radio frequency field; and
- a magnetic field-modifying structure (60) designed to enhance the temporally constant magnetic field, the magnetic field-modifying structure having a longitudinal demagnetization factor (N_z) parallel to the temporally constant magnetic field and a tangential demagnetization factor (N_T) in a tangential direction transverse to the temporally constant magnetic field, the longitudinal demagnetization factor being larger than the tangential demagnetization factor to produce tangential flux guiding.
- 16. The magnetic resonance imaging scanner as set forth in claim 15, wherein the magnetic field-modifying structure (60) includes:
- a plurality of generally annular structures (62) oriented generally transverse to the temporally constant magnetic field, the annular structures having annular cross-sections elongated transverse to the temporally constant magnetic field.
- 17. The magnetic resonance imaging scanner as set forth in claim 15, wherein the magnetic field-modifying structure (60) includes:

ferromagnetic particles (70₁, 70₂, 70₃, 70₄) that are generally smaller than a skin depth of the radio frequency field in the magnetic material in at least one dimension; and an insulating binder (72) in which the ferromagnetic particles are dispersed.

- 18. The magnetic resonance imaging scanner as set forth in claim 17, wherein the ferromagnetic particles $(70_1, 70_2, 70_3, 70_4)$ are dispersed in the binder (72) with a fill factor greater than about 50% by volume.
- 19. The magnetic resonance imaging scanner as set forth in claim 17, wherein the ferromagnetic particles $(70_2, 70_3)$ have an anisotropic particle demagnetization factor with a largest particle demagnetization factor component generally oriented in the direction of the temporally constant magnetic field and a smaller particle demagnetization factor component oriented in a tangential direction transverse to the direction of the temporally constant magnetic field.